

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1      Claim 1 (currently amended): A method for calibrating  
2      parameters of sensor elements in a sensor array, comprising  
3      the steps of:

4      receiving ~~an output signal signals~~ of at least two  
5      sensor elements ~~signal~~ in reaction to an input signal from a  
6      signal source;

7      estimating a cross-correlation between the output  
8      signals of at least two of said sensor elements;

9      optimising a difference between the estimated  
10     cross-correlation and a cross-correlation model; and

11     ~~thereby~~-estimating said parameters from the optimised  
12     difference;

13     wherein ~~a~~the cross-correlation model is used as  
14     represented by the following mathematical equation:

$$R = G B G^H + D$$

16     in which~~equation~~:

17      $R$  represents a cross-correlation matrix,

18      $G$  represent a gain matrix comprising gain parameters,

19      $G^H$  represents ~~the~~an Hermitian conjugate of the gain matrix,

20      $D$  represents a ((block) diagonal) noise matrix comprising  
21     noise parameters and

22      $B$  represents a matrix comprising information about the  
23     signal source.

1       Claim 2 (original): A method as claimed in claim 1, wherein  
2       said difference is a least square difference.

1       Claim 3 (previously presented): A method as claimed in  
2       claim 1, wherein the cross-correlation is obtained by  
3       determining a time-averaged covariance matrix from the  
4       output signals.

1       Claim 4 (previously presented): A method as claimed in  
2       claim 1, wherein the sensor array is a single polarization  
3       or non-polarized sensor array.

1       Claim 5 (previously presented): A method as claimed in  
2       claim 1, wherein the sensor elements are dual polarization  
3       sensor elements for receiving a dual polarised signal.

1       Claim 6 (previously presented): A method as claimed in  
2       claim 1, wherein said method is performed for output signals  
3       of the sensor elements generated in reaction to input  
4       signals from at least three signal sources with different  
5       polarizations.

1       Claim 7 (original): A method as claimed in claim 4, wherein  
2       said optimising comprises:  
3       minimising a difference between a weighted logarithm of the  
4       estimated cross-correlation and a weighted logarithm of the  
5       cross-correlation and  
6       estimating the gain of at least one of the sensor elements  
7       from said difference.

1       Claim 8 (original): A method as claimed in claim 7, wherein  
2       the logarithm is weighted by a weighting matrix with matrix  
3       values relating to said gain parameters.

1       Claim 9 (previously presented): A method as claimed in  
2       claim 7, wherein said optimising and said estimating gain  
3       parameters are performed at least a first time and a second  
4       time, wherein in the first time an uniform weight is used  
5       for all output signals and in the second time the weight is  
6       used in dependence on the gain estimated in the first time  
7       for the respective output signals.

1       Claim 10 (previously presented): A method as claimed in  
2       claim 7, wherein said optimising comprises an operation as  
3       represented by the mathematical equation:

4  
5        $\{g_{est}\} = \text{argmin}_{g,k} (\| W J \text{vec}(\ln(R_{est}) - \ln(g g^H) + 2\pi k i) \|_F)^2,$   
6       in which equation:  
7        $g_{est}$  represents the parameter to be estimated;  
8        $g$  represents a variable;  
9        $g^H$  represents the Hermitian conjugate of the variable;  
10       $J$  represent a selection matrix which puts zeros on the main  
11      diagonal;  
12       $k$  represents a phase unwrapping vector containing integer  
13      values;  
14       $W$  represents a weighting matrix; and  
15       $R_{est}$  represents the estimated cross-correlation.

1       Claim 11 (previously presented): A method as claimed in  
2       claim 1, wherein the signal source is a satellite in orbit  
3       around a celestial body.

1       Claim 12 (previously presented): A method as claimed in  
2       claim 1, wherein the signal source is a pulsar.

1       Claim 13 (previously presented): A method as claimed in  
2       claim 1, wherein the output signals have a low signal to  
3       noise ratio.

1       Claim 14 (previously presented): A method as claimed in  
2       claim 1, wherein the sensor elements are antennas in a  
3       phased array antenna.

1       Claim 15 (previously presented): A method as claimed in  
2       claim 1, wherein the sensor elements are electro-magnetic  
3       sensors elements.

1       Claim 16 (previously presented): A method as claimed in  
2       claim 1, wherein the sensor elements are acoustical sensor  
3       elements.

1       Claim 17 (currently amended): A calibration system for  
2       calibrating parameters of sensor elements in a sensor array,  
3       the system comprising:

4               at least two inputs, each connectable to an output of  
5       an—a sensor element in a sensor array;

6               a correlation estimator device for estimating a  
7       correlation between the—output signals of at least two of  
8       said sensor elements;

9           an optimiser device for optimising a difference between  
10          the estimated cross-correlation and a cross-correlation  
11          model and ~~thereby~~-estimating said parameters from the  
12          optimised difference; and

13          a memory device containing the cross-correlation model,  
14          ~~which~~the model is being represented by the following  
15          mathematical equation:

$$R = G B G^H + D$$

16          in whichequation:

17          R represents a cross-correlation matrix,

18          G represent a gain matrix comprising gain parameters,

19          G<sup>H</sup> represents ~~the~~an Hermitian conjugate of the gain matrix,

20          D represents a noise matrix comprising noise parameters and

21          B represents a matrix comprising information about the  
22          signal sourceand.

1          Claim 18 (previously presented): A calibration system as  
2          claimed in claim 17, wherein the sensor array is a dual  
3          polarised sensor array.

1          Claim 19 (original): A calibration system as claimed in  
2          claim 17, wherein the sensor array is a single polarization  
3          or non-polarized sensor array.

Claim 20-22 (cancelled).

1          Claim 23 (new): An array signal processing system having  
2          sensor elements and a calibration system for calibrating the  
3          sensor elements, the calibration system comprising:

4           a device for receiving output signals of at least two  
5           sensor elements in reaction to an input signal from a signal  
6           source;

7           a correlation estimator device for estimating a  
8           cross-correlation between the output signals of at least two  
9           of said sensor elements;

10          an optimiser device for optimising a difference between  
11          the estimated cross-correlation and a cross-correlation  
12          model; and

13          an estimator device for estimating said parameters from  
14          the optimised difference;

15          wherein the cross-correlation model is represented by  
16          the following mathematical equation:

$$R = G B G^H + D$$

17          in which:

18           $R$  represents a cross-correlation matrix,

19           $G$  represent a gain matrix comprising gain parameters,

20           $G^H$  represents an Hermitian conjugate of the gain matrix,

21           $D$  represents a ((block) diagonal) noise matrix comprising  
22          noise parameters, and

23           $B$  represents a matrix comprising information about the  
24          signal source.

26          Claim 24 (new): A computer program having computer  
27          executable instructions and stored in a computer readable  
28          medium and which, when the instructions are executed by a  
29          programmable computer, perform the steps of:

30           receiving output signals of at least two sensor  
31           elements in reaction to an input signal from a signal  
32           source;

34        estimating a cross-correlation between the output  
35        signals of at least two of said sensor elements;

36        optimising a difference between the estimated  
37        cross-correlation and a cross-correlation model; and

38        estimating said parameters from the optimised  
39        difference;

40        wherein the cross-correlation model is used as  
41        represented by the following mathematical equation:

42                  
$$R = G B G^H + D$$

43        in which:

44         $R$  represents a cross-correlation matrix,

45         $G$  represent a gain matrix comprising gain parameters,

46         $G^H$  represents an Hermitian conjugate of the gain matrix,

47         $D$  represents a ((block) diagonal) noise matrix comprising  
48        noise parameters and

49         $B$  represents a matrix comprising information about the  
50        signal source.

51  
52        Claim 25 (new): A computer readable medium having computer  
53        executable instructions stored therein, said instructions,  
54        when being executed by a computer, perform the steps of:

55        receiving output signals of at least two sensor  
56        elements in reaction to an input signal from a signal  
57        source;

58        estimating a cross-correlation between the output  
59        signals of at least two of said sensor elements;

60        optimising a difference between the estimated  
61        cross-correlation and a cross-correlation model; and

62        estimating said parameters from the optimised  
63        difference;

64       wherein the cross-correlation model is used as  
65       represented by the following mathematical equation:

66                    $R = G B G^H + D$

67       in which:

68       **R** represents a cross-correlation matrix,

69       **G** represent a gain matrix comprising gain parameters,

70       **G<sup>H</sup>** represents an Hermitian conjugate of the gain matrix,

71       **D** represents a ((block) diagonal) noise matrix comprising  
72       noise parameters and

73       **B** represents a matrix comprising information about the  
74       signal source.